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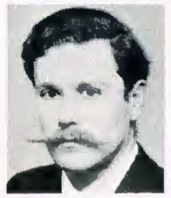
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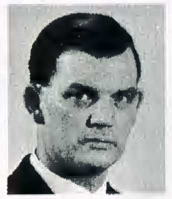
Martin Wray


Josiah Ehrlich

CONTRIBUTORS

Tom Howie is general director of ICI (Europa) Fibres GmbH. He joined BNS in 1945 and was concerned with the first production of nylon yarn in the pilot plant and the construction of the main plant at Pontypool. Seconded to BNS(A), now Fibremakers Ltd., from 1956 to 1958, he was responsible for constructing and putting into operation the factory at Bayswater, near Melbourne. Was appointed as general manager of Nylon Faserwerke in 1964 and general manager designate of the Fibres group of ICI (Europa) last October.

Nicholas Flemming is now doing research for the Commercial Oceanology Study Group after studying sediment transport in the English Channel with a research Fellowship from the Department of Scientific and Industrial Research. Diving for the Special Boat Section in the Royal Marines aroused his interest in oceanology, and he went on to do a PhD on submarine geology of the Mediterranean at Cambridge.

Peter Menzies has been ICI Finance Director since 1956 and Director responsible for the Company's metals interests since 1964. He has been a director of IMI since it was formed in 1962 and was appointed its Chairman in 1964. His first close association with the metals interests of the Company began with a directorship of Yorkshire Imperial Metals Ltd. when it was formed, and he is now the Deputy Chairman.

Sam Howard became Chairman of Pharmaceuticals Division in 1960 after being transferred from Dyestuffs Division, where he was appointed managing director towards the end of his 38 years' service there.

Martin Wray has dealt with East European affairs in Head Office since 1961 and is now assistant head of East European Department. He also helps Mr. Harold Smith – the ICI Director responsible for Eastern Europe and China – in matters concerning the sale of ICI processes in these markets. A Cambridge graduate, he worked as an industrial photographer and in the Foreign Office before he joined Plastics Division in 1960.

Josiah Ehrlich is now engaged in research into nuclear and other special emulsions after several years as head of the colour filter department at Ilford. After graduating from London University he joined Ilford Ltd. in 1937. He is an Associate of the Institute of Physics.

COVERS: *No. 4 Olefine Plant, Wilton*

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Bri-Nylon dress by Estrava

OESTRINGEN: *£13 million breakthrough into Europe* ▷

OPERATION OESTRINGEN

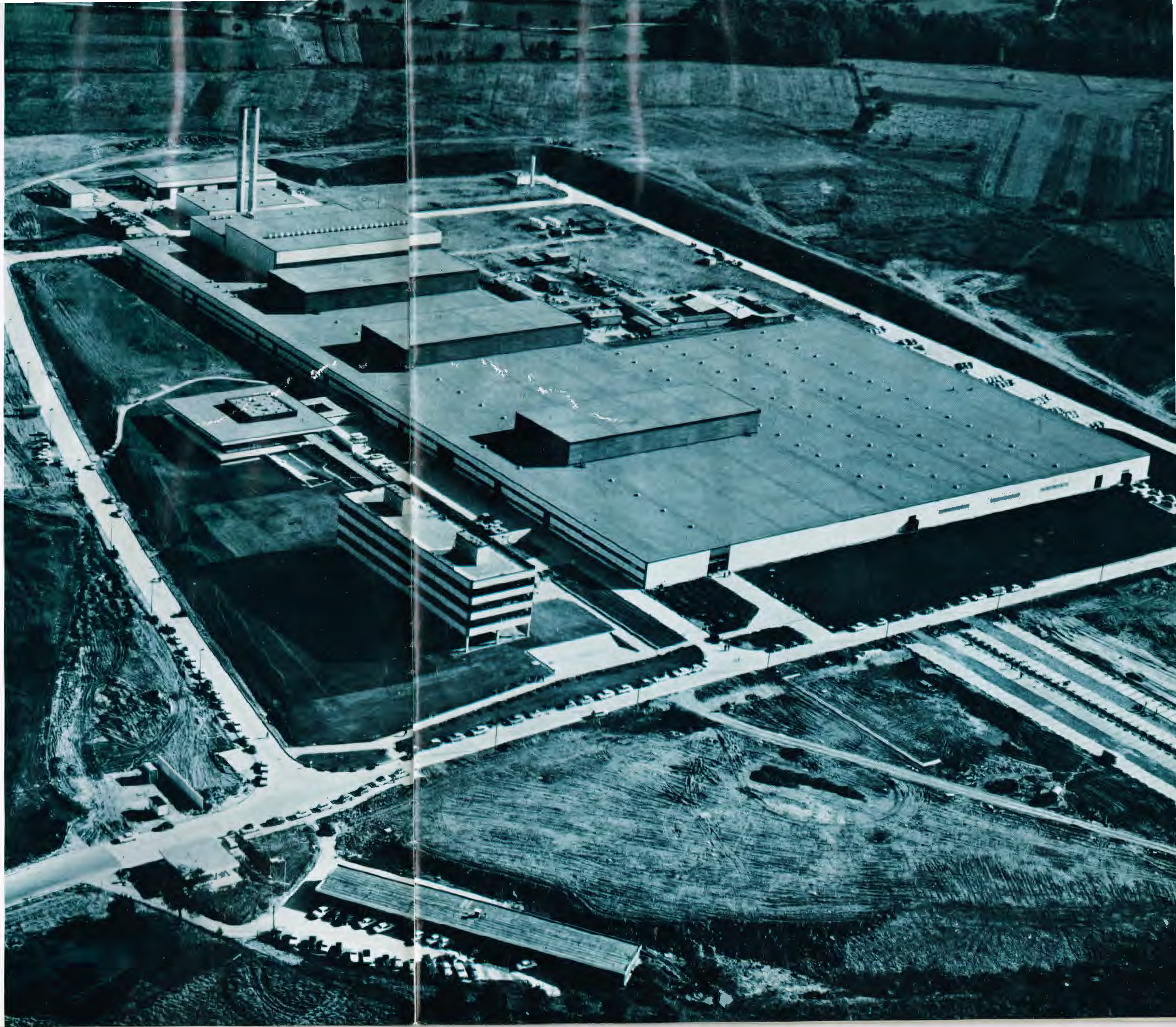
TOM HOWIE

One of the signs of a country's rising standard of living is a growing demand for the easy-care clothing and household goods made from synthetic fibres. People, especially women, want the pleasure of clean, good-looking clothes and furnishings – but they also want more leisure. A day in the country is much more attractive than a day spent mending and ironing.

This is the background to ICI Fibres' first manufacturing foray into Europe, originally set in motion by British Nylon Spinners Ltd. early in 1963. The economic achievements of countries within the European Common Market have given them a spending power which is encouraging to any big fibres producer. Seeing excellent opportunities for expansion, so long as tariff barriers could be overcome, BNS, who were already Europe's largest producer of nylon yarns, sent out a team to study the problems of setting up a factory right inside the prosperous Continental market.

This proved a complicated business. Industrial methods in the various possible countries had to be studied. Dozens of sites were inspected. The physical production of nylon yarns imposes certain rigid site requirements, apart from the obvious need for good communications with customers. Finally, in October 1963, Mr. F. C. Bagnall, who was then managing director of BNS and is now ICI Commercial Director, announced that a site had been chosen at Oestringen in the province of Baden-Württemberg, about 20 miles from Heidelberg. This site offered the necessary technical facilities: about 100 acres of flat building land, clean air and a good power supply. It is a rural area, still a country of economic contrasts: pylons stand among fruit trees and vines, the Volkswagens sweep past an occasional ox-cart. But communications are good, since the Frankfurt-Karlsruhe autobahn is only a few miles away.

The first nylon yarn was spun at Oestringen in the spring of 1965, only twenty months after construction work first began on a "green fields" site. In the meantime BNS had been merged with the former ICI Fibres Division to form ICI Fibres Limited, a subsidiary company of ICI based on the UK but with world-wide associations. Following the formation of ICI (Europa), with its chemical complex at Rozenburg near Rotterdam, the company operating the Oestringen factory was named ICI (Europa) Fibres GmbH. *(Continued on page 78)*



The new £13,000,000 factory opened on 22nd April by ICI (Europa) Fibres GmbH in Western Germany is part of a planned £25m. investment by ICI in synthetic fibres for the European market

After working on the construction of nylon yarn plants in the UK and in Australia, I found in the early stages that my biggest practical problem lay in getting used to the very different governmental structure in Germany, where every detail of factory design, right down to the provision of lockers, is covered by statutory requirements. Although this led to a mass of paper work, it also turned out to be the basis of continuing friendly relations with local officials, whom we found very co-operative in helping us through this complicated maze of regulations.

Co-operative spirit

A similar co-operative spirit among officials concerned with employment has made what could have been a complicated problem in labour recruitment comparatively easy. The Minister of Labour of Baden-Württemberg, Herr Josef Schüttler, speaking at the official opening ceremony, admitted that when we first went to the district other local industrialists were afraid that we would attract their workers away from them. Press reports had given our eventual labour requirements as 1,800 people, not easy to find in this district of small, scattered communities. Herr Schüttler said that because we had worked so closely alongside their labour department we had been able to recruit our work force without unreasonable disturbance. Since people are drawn from a wide radius some thirty miles around the factory, it has only been necessary to draw a relatively small number from each village and therefore an even smaller number from any one firm. Dr. Kersel, Personnel Director, finds that now the works has a local image people are applying for jobs of their own accord. Certain grades of qualified people are difficult to find, such as trained laboratory assistants, so a laboratory training scheme has been established to overcome this bottleneck. Process operatives are trained by methods already well tested in the UK. Early recruits had a period of training in the newest UK nylon factory at Gloucester and have helped to train others.

The mayor of Oestringen, Herr Kimling, welcoming this new influx of "clean, safe and well-paid jobs" in what had been a commuter community, praised the way in which "this big, modern factory has been integrated so skilfully in the Oestringen landscape." This was the carefully-planned achievement of Professor E. Heinle, the architect responsible for the very rapid construction of this air-conditioned plant.

At present only nylon yarns are produced at Oestringen, melt-spun from nylon 6.6 delivered from ICI plants in England and at Rozenburg. Production is now steadily

Right: Tom Howie, General Director, ICI (Europa) Fibres GmbH, who has been in charge of the Oestringen project from the start and is the author of this article

Below: Research staff at work. A special training scheme for laboratory assistants has been established

The Chairman, Sir Paul Chambers, prepares to sign the official visitors' book. With him are Dr. Franz Gurk, Landsrat President of Baden-Württemberg, seated left, and (signing) Sir Frank Roberts, British Ambassador to Western Germany. Standing beside him is Oestringen's Burgomaster, Herr H. Kimling. Seated, right, is Regierungspräsident Dr. W. Munzinger

Left: An employee checks the quality of nylon yarn during a stage in manufacturing

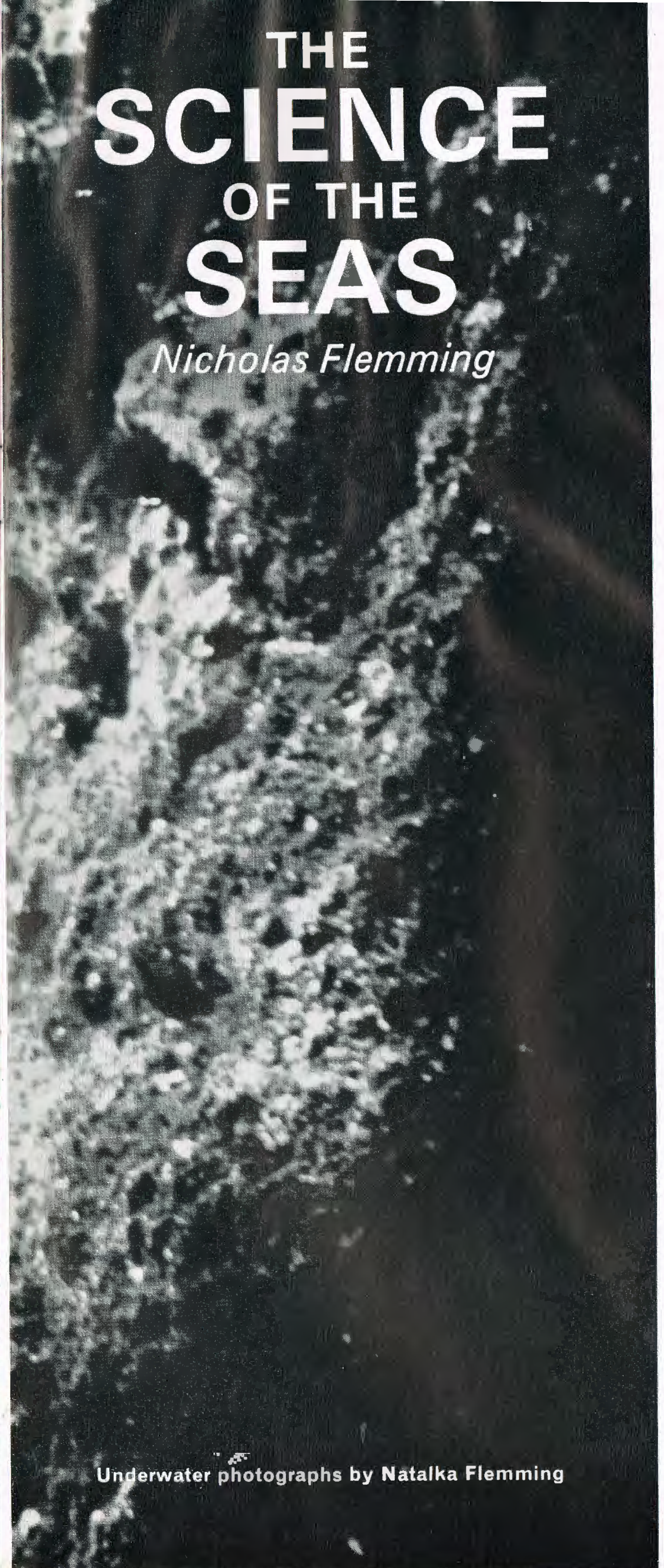
Bottom: Night shift at Oestringen

increasing towards an estimated target of 20,000 metric tons a year. On 29th March of this year ICI announced that production of synthetic fibres at Oestringen would be expanded to include 5,000 metric tons a year of their polyester fibre 'Terylene,' bringing their total European investment in synthetic fibre plant to well over £25 million. Plant construction and the training of operatives will start this autumn. A major proportion of this 'Terylene' output will be in the form of continuous filament yarns suitable for bulking by the 'Crimplene' process.

A complete range of nylon yarns will be made at Oestringen, including continuous filament yarns and staple fibre for textile and industrial end uses. Goods made from these yarns will be marketed under the ICI brand name Bri-Nylon. Already considerable ranges of Bri-Nylon swimsuits made by leading German manufacturers are in the shops, as well as knitwear, lingerie and leisurewear. Bri-Nylon hand-knitting yarns, an important sector of UK trade but as yet unknown in Germany, are to be introduced soon. Mr. P. G. Beazley, who as Deputy General Director of ICI (Europa) Fibres is responsible for sales and marketing, points out that we can bring to Germany the international experience we have gained in other countries, new exciting ideas from which our customers will benefit.

For the future, technical innovation is of the first importance. Dr. P. Hatfield, who is in charge of the Textile Development Department at Oestringen, emphasises that one of its main functions is to develop new merchandise from our yarns. This is the latest of what is now a world-wide chain of TDDs associated with ICI Fibres, at Harrogate and Pontypool in the UK, in the USA, Canada, Australia, New Zealand and South Africa, forming a nucleus of research and technical knowledge. Initially a group of textile engineers, recruited in Germany, were trained in England to provide the basic technical staff. Resources in staff and equipment are now being built up to support the marketing and sales organisations. The development of carpet yarns, industrial yarns and weaving is increasing. Next year 'Terylene' will be included in service and development activities.

In an industry concerned eventually with such highly-personal purchases as clothing and household textiles it is essential to keep very close to the customer. Private preference makes the final choice. So Bri-Nylon, 'Terylene' and 'Crimplene' merchandise must be developed which takes into account the specific requirements of each country where it will be marketed. As the largest synthetic fibre producer in Europe, ICI is well placed to take a lead in the specialities and innovations on which any fibre producer must depend if he is to keep ahead in an extremely competitive market. Sir Paul Chambers, Chairman of ICI, speaking at the opening ceremony at Oestringen, said: "The future trend of demand for man-made fibres, polyamides, polyesters, polypropylene and acrylics, appears to slope upward steadily and indefinitely. I hope to see a steady expansion of our manufacturing activities in Germany and in neighbouring countries."



THE SCIENCE OF THE SEAS

Nicholas Flemming

Underwater photographs by Natalka Flemming

How much easier it would be to mine the sea floor if the sea was not there! The biological productivity of the oceans is said to be the same, acre for acre, as the land, but "farming" or "mining" of the seas is much more difficult. Nature is not offering us wealth on a platter: our ancestors knew very well that they could not farm the open sea, or mine the sea floor, although fish were cultivated in sea pools in the first century B.C., and a coal-mine was first extended under the Firth of Forth in 1560.

Good arable land and pasture are scarce, and world reserves of certain key minerals, especially tin, lead and sulphur, are disturbingly low. We therefore have to consider the possibility of extracting food and metals from sea water. Modern technology can do both these things, but the problems tend to be just as massive as the opportunities.

To take one example: the total weight of manganese rocks, which are known as nodules, on the Pacific Ocean floor is said to be one and a half million million tons, and more are steadily being formed at a rate of six million tons a year. The maximum proportions of the most common metals found in the various regions of nodules are 41% manganese, 26% iron, 2·3% cobalt, 2% nickel and 1·6% copper.

Not only would the quantities in the ocean floor provide thousands of years of reserves at present levels of consumption, but the rate of cobalt accumulation is actually greater than present world usage and manganese is accumulating at about one-third of the rate of world consumption. Thus the mining of nodules appears to be attractive. So it is—but a mining operation in 10,000 ft. of water needs a surface vessel of about 15,000 tons in order to control some 2,500 tons of submerged pipe, machinery, ballast tanks, pumps, cables, television equipment, suction heads, filters, and so on. Simple calculations based on what it would cost to assemble and operate such a system tend to ignore the immense amount of preliminary research and development required to make the equipment reliable. Without such development the whole lot would probably be lost overboard within a week.

To get some idea of how far short present technology is of gathering manganese nodules you have only to consider the American recovery of the lost H-bomb off the coast of Spain. After the submarine *Alvin* had located the bomb at a depth of 2,500 ft. the remaining problem was to attach a 1-inch thick rope and secure it : a task which would have required perhaps one minute for one man on land took two submarines and one remote-controlled vehicle several days. The resulting success was a fantastic technical achievement, but it is a long way from being able to pick up tons of manganese nodules at ten times the depth.

We simply do not know enough about the performance of materials under pressure in the surroundings of water and subject at the same time

to mechanical stress and vibration; about the behaviour of two miles of pipe hanging from a ship rocking on the waves; about the effects of currents travelling in different directions at different depths on the two miles of pipe.

An enormous amount will be learned about the problems of working on the sea floor in thousands of feet of water from the forthcoming American "Mohole" project, which is a plan to drill through the earth's crust under the Pacific Ocean to sample material of the "mantle" beneath. The cost of this project, which has risen rapidly since it began, is now estimated at £30m. and is still climbing. Although the project will probably be worth it, this scale of costs provides a salutary warning to anyone attempting to work in the deep ocean.

Ever since a German expert planned to pay his country's debts after the first world war by extracting gold from the sea, people have been trying to extract every kind of mineral from sea water. Their hopes have been raised by figures which show that all the seas in the world contain enough gold for every man, woman and child on earth to have 6 lb. of gold each, worth about £1,000 at present prices. Unfortunately it would cost many times this to extract the gold! Similar calculations can be made for other valuable metals.

Elusive elements

Large amounts of common salt, bromine and magnesium are today extracted economically from sea water, and iodine is extracted from seaweed; but other elements remain elusive. Most elements are present only in very dilute quantities, less than one part per million. This means handling very large volumes of water to get a reasonable output. Now the volume of water to be dealt with would greatly exceed the amount which could usefully be desalinated for drinking or industrial use, so that a combination of mineral extraction and desalination, which would be economically more attractive, is not easily possible.

Another difficulty is that the widely differing proportions of the various elements in solution make it impossible to extract useful quantities of all the minerals from the same bulk of water. The actual value of common salt in a given volume of water is, for example, many thousands of times greater than the value of the gold. Common salt is present in a concentration four thousand million times greater than that of the gold, with most other minerals in between. Thus a plant which processes the right amount of, say, boron for a given population would produce 30 times too much common salt and less than one ten-thousandth of the required amount of copper.

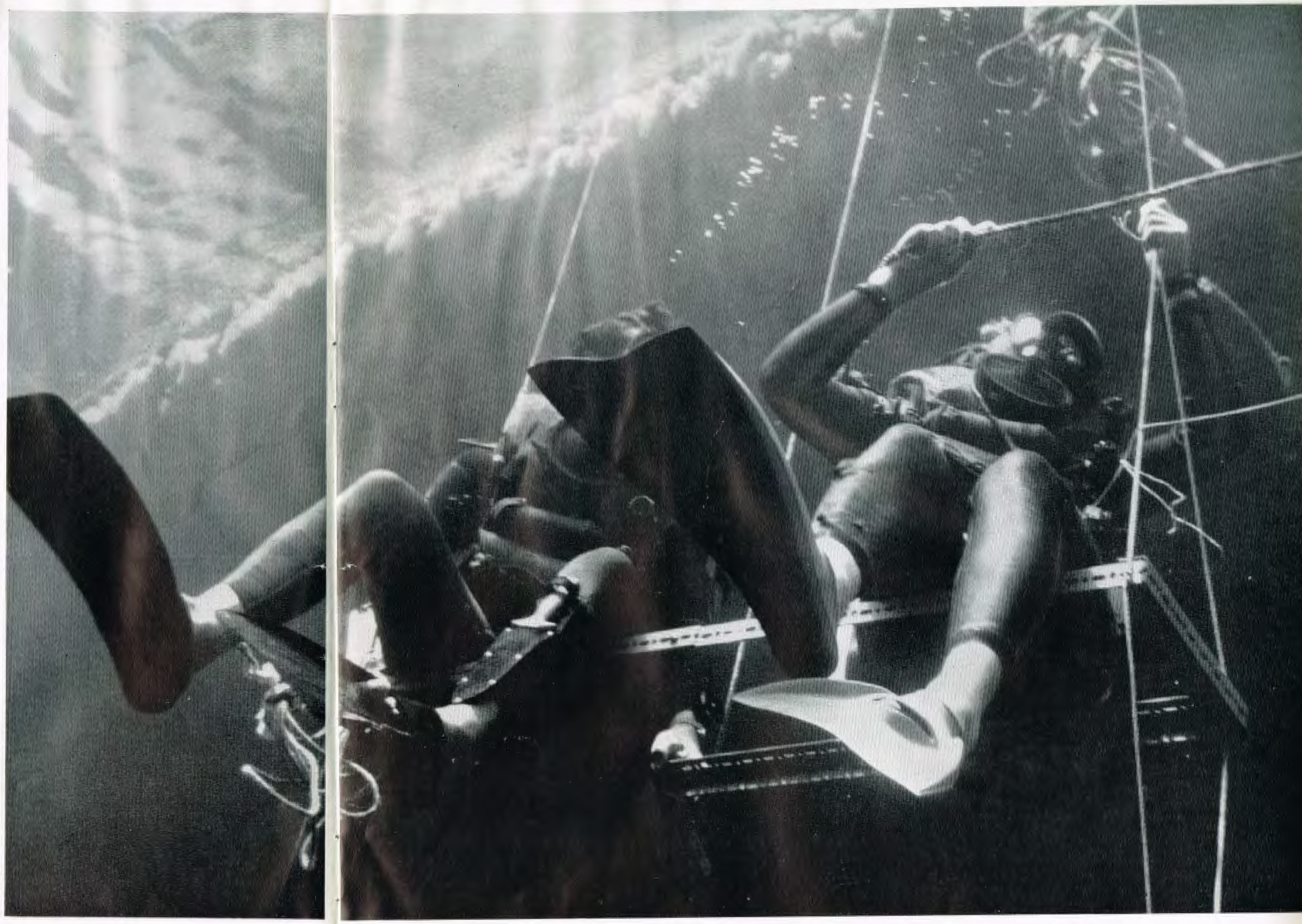
To extract minerals other than the most common ones we must design a plant which is extraordinarily economic in extracting a very small group of elements of closely similar concentrations. A scheme of this kind has recently been suggested by Dr. R. Spence, FRS, director of the Atomic Energy Research Establishment at Harwell, for extracting uranium, which exists in similar values to fluorine, iodine, molybdenum, vanadium and tin.

The scheme avoids the problem of building a factory to deal with enormous volumes of water by proposing to use tidal lagoons which would fill through sluice gates from the sea and drain at low tide through absorbent beds of insoluble hydrated titanium oxide. This absorber is very efficient for uranium, and others might be developed for other elements. The resulting product would be equivalent to a low-grade ore. The process is being considered in France as well as in Britain.

On balance, then, the greater extraction of minerals from the sea water is a serious possibility, but much work has still to be done before it becomes economic.

In biology there is an extraordinary variety of possibilities. Batteries have been made which utilise the biological activity of seaweeds and bacteria to convert solar and chemical energy into electricity. Plankton, the tiny drifting organisms found in the sea, is cultivated as human food, or as fodder for fish or other animals. Thirteen per cent of the world's fish catch comes from inland waters, many of which are cultivated to produce fish. Pharmaceuticals and biologically active drugs can be extracted from marine plants and animals. Many kinds of sea fish and shellfish such as crabs and lobsters have been "cultivated" experimentally in enclosed pools or tanks.

A problem for industrialised countries is that many of these activities already exist as peasant-based crafts and must be converted into large-scale science-based technologies before they can become economic. In other words, the methods of production must be changed from labour-intensive to capital-intensive, but this can be enormously complex and difficult.



Two divers, equipped with oxy-helium breathing apparatus, decompressing after a 200 ft. dive off Malta

Powerful toxins

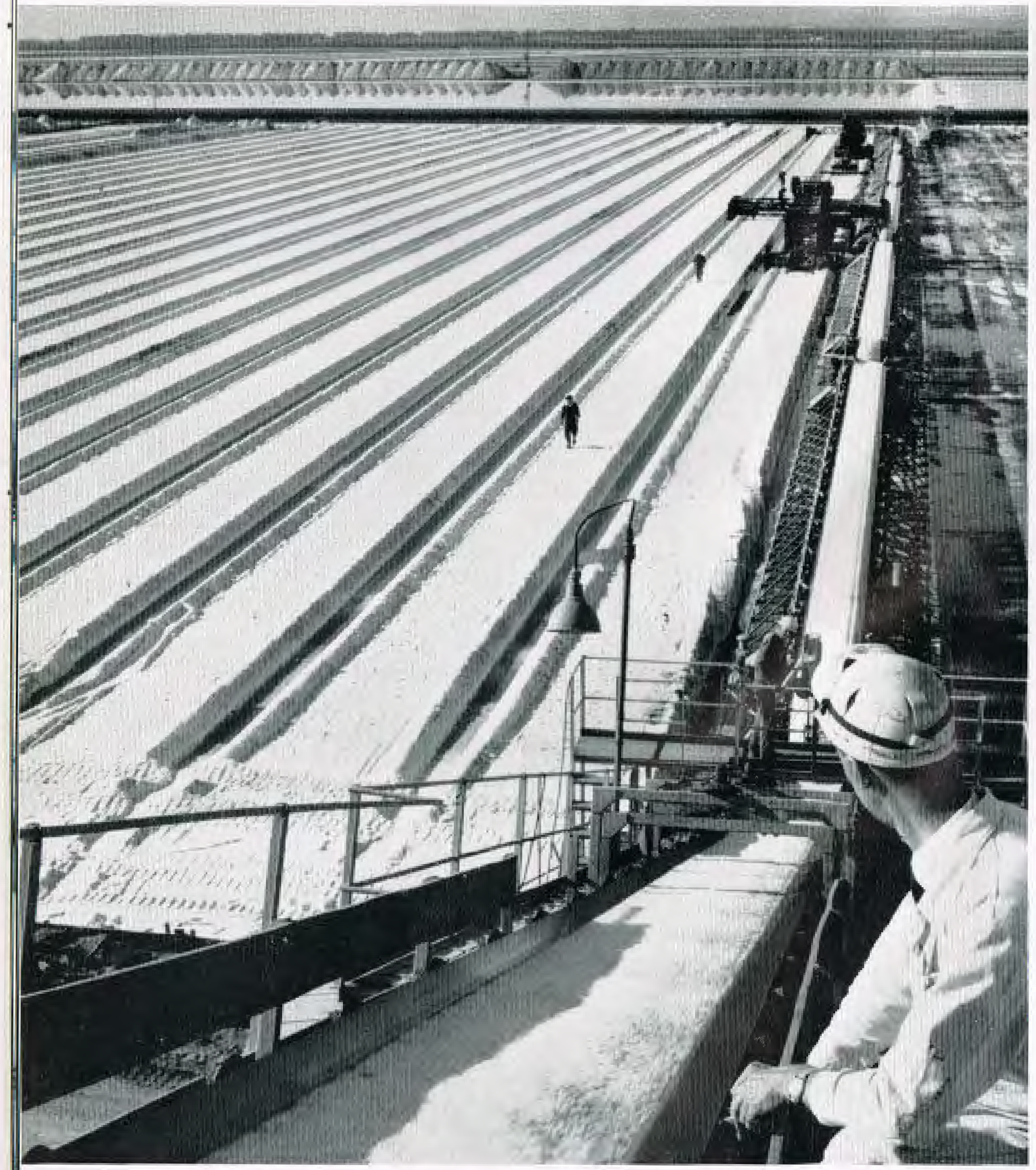
The production of pharmaceuticals from the sea is an example. Disregarding insects, which belong almost exclusively to the land, the variety of living species in the sea is as great as or greater than the variety of all species on land. In addition, their classification is complex and uncertain, and new species are being discovered all the time. Some of these species contain powerful toxins which (if they could be extracted) might have valuable relaxant or anaesthetic properties; but the task of screening all the species for useful chemicals is prodigious, and no theoretical knowledge is available to shorten the slow process of trial and error. Nevertheless, biological teams in various laboratories are working on this problem.

The steps required to make sea farming economic are more obvious but no easier. Marine populations must be studied genetically to select strains which grow fast on little food, are resistant to disease, tolerant of variable conditions and overcrowding, able to accept a variable diet and breed true. With land mammals, generations are long, numbers of offspring small; with marine species a single female may lay a million eggs, and we have little experience of the kind of genetic statistics associated with their development and survival, or lack of it. Control of the conditions in which the fish or crustacea grow may also be critical, and chemical analysis of the water and automatic adjustment of its composition may be necessary. At the end of it all, a fish must be produced which compares in quality with one fresh from the sea, is large enough to be processed and preserved, and is also cheap. This is a tall order, but several laboratories in various countries are engaged on the problems involved.

Work in the sea requires new instruments, new methods and new materials. High-strength alloys resistant to stress corrosion, plastics to prevent corrosion or give transparency, syntactic foams to give invariable buoyancy, ropes which do not twist under load—all these and more are needed. The research and development problems are tremendous, for this is a "new frontier" almost as strange and, many would claim, every bit as challenging as space research. In terms of a return which will directly benefit people everywhere it may also prove to be more rewarding in the long run.

Living under water

There is not space here to deal with all the possible developments in the field of unconventional underwater systems, mining of the Continental Shelf, civil construction methods, meteorological prediction, and navigation and communication services. One which should be mentioned, since it has received so much recent publicity, is that of living under water possibly for days or weeks at a time. As the exploitation of the minerals of



At the ICIANZ saltfields at Dry Creek, in South Australia, more than 400,000 tons of salt is being harvested each year from sea water in crystallising ponds like this one

Relative amounts of the main minerals to be found in a cubic mile of water:

Sodium chloride (common salt):
77·72% (120 million tons)

Magnesium chloride:
10·8% (27 million tons)

Magnesium sulphate (epsom salts):
4·74% (8 million tons)

Calcium sulphate:
3·6% (6 million tons)

Potassium sulphate:
2·46% (4 million tons)

Calcium carbonate:
0·34% (564,000 tons)

Magnesium bromide:
0·22% (365,000 tons)

the Continental Shelf proceeds out to depths of 300–600 ft., there will be times when only a man on the spot can solve a problem or repair a piece of damaged machinery. It is therefore important to develop diving techniques and underwater "houses" for these depths. In addition to the much-publicised exploits of Cousteau's team and the recent American "Sealab" project, small, permanent, concrete laboratories have already been erected in shallow water off Hawaii, so that researchers can remain submerged for hours or days. Few people would want to live on the sea floor from choice, and in any commercial project the aim will be to operate without men having to do so. Nevertheless the time will come when a man who can go down with a spanner may save a lot of money and prevent a lot of difficulties.

The oceans, then, can be seen by the scientist as a prolific source of biological production, minerals in solution, and power —and also as the obstacle to obtaining minerals and fertilizers from the sea floor below. They are also, in themselves, a means of communication, transport and recreation. The task of the marine technologist is to minimise the obstacles, to maximise the productivity, and to improve the services. In all three areas more experts are needed, and already the overall world turnover on ocean engineering and marine research is growing at the rate of 15 per cent a year.

The Commercial Oceanology Study Group was created to provide member companies with information on the prospects and problems of marine exploitation, and in so doing to help them make the right decisions about their own marine research and production policies and programmes.

This group was set up by six companies—ICI, British Petroleum, Richard Costain, the Hawker-Siddeley Group, the Rio Tinto Corporation, and Unilever. Each company is already working on one or more of the different but related fields of oceanology, and each will contribute to the study from its own experience and knowledge.

The study began last September and is expected to last about twelve months. The ICI representative on the Group is Mr. John Wren-Lewis of Research and Development Department at Head Office.

BP are interested in the development of undersea oil exploration and drilling, the use of floating oil rigs and the laying of pipelines on the sea bed. Rio Tinto have an interest in the extraction of minerals from the sea or the "mining" of the sea floor, Hawker-Siddeley are interested in all forms of surface and underwater craft, and Costain are involved in the construction of harbours and coastal protection and in the development of new techniques and materials for building on or under the sea. Unilever are interested in obtaining food from the oceans, particularly fish and fish products, and ICI's interests cover a wide range, from fuels for underwater craft to the extraction of chemicals from sea water or the supply of plastics materials for sea-bed "houses."

Mr. D. R. Scorer

of African Explosives and Chemical Industries Limited

Mr. D. R. Scorer succeeded Mr. C. E. Hughes as Managing Director of African Explosives and Chemical Industries Ltd. on 1st April. He has had an adventurous life. Born in Cheshire fifty-two years ago, he went to school at Repton and afterwards studied law. At that time he expected to take his place in the family law firm of which his grandfather was senior partner and two of his uncles were partners. However, some of his cousins had prior claims to the few vacancies that happened to be open in the firm, so he was unlucky.

Undeterred by the change in his prospects, the young man remembered that he had an aunt living at Sevenoaks, and decided to come south and reconnoitre some of the London firms of solicitors specialising in commercial law, which he had made his subject, and some of the commercial houses which employed their own solicitors. A friend in ICI gave him an introduction to Mr. J. E. James, the Secretary. Mr. James and the Staff Department saw him, took his particulars, and a month later offered him a post with what was then ICI (Lime) Ltd. (later the Lime Division) as the Assistant Secretary. This was in 1937. The standard salary for a newly-qualified solicitor then was £150 a year —incredible as it must seem today. ICI was, however, able to offer £275, which was eagerly accepted. The young Scorer was much impressed. He thought at the time that ICI must be a very good firm indeed. It is pleasant to record that he is of the same opinion today.

He was hardly in his new job when the international scene began to darken. He therefore joined the Territorial Army in Buxton in the ranks. When the storm was about to burst in 1939, Derek Scorer returned to London as an anti-aircraft gunner and was granted his commission the day before war broke out. In 1943 he found himself, as second-in-command, in charge of the administration of a gunner unit, 350 strong, sent over to America to demonstrate gun drills to the US Army. One hundred and fifty US Army personnel were attached to the unit on arrival to handle the domestic side of the unit's affairs, such as driving and cooking.

This part of his assignment was fairly straightforward, but once arrived his contingent found itself involved in all kinds of extraneous activities, from taking part in patriotic rallies in support of war bond sales, which were currently being staged in cities by the US War Department, to formally receiving delivery of a Liberty ship just completed in a shipyard in North Carolina

for Britain's hard-pressed merchant fleet. On this occasion the rousing oration which he delivered to the shipyard workers from a platform high up on the bows of the ship was entirely lost upon his audience, who understood not a single word because of his "British" accent!

He retains colourful memories of American hospitality to his unit, including a party of welcome thrown by Billy Rose at his famous Diamond Horseshoe cabaret in New York, when some 350 British fighting-men were formed up in columns of three on the pavement outside, marched indoors, and after as much dancing and feasting as could be got into a period of two hours, somehow re-formed in the street and marched away, again as spruce and orderly as if on the barrack square.

At the close of the nine-month tour he was seconded to the British Army Staff at Washington, DC, for three months.

His military and other duties across the Atlantic concluded, Derek Scorer was put in command of the Central Gun Battery in the London Area HAC headquarters in London. Thereafter he became a mobile AA gunner and stood by for duty in the Japanese and German wars. And then came the war's end. He was offered a major's job in the finance section of the Control Commission in Germany, but ICI decided otherwise. Derek Scorer came back to the Company and became a member of the Secretary's Department at Millbank in 1945. Later he applied for and was appointed to the post of Assistant Secretary to African Explosives and Chemical Industries in Johannesburg, which was advertised at the end of 1946, and he left London on 24th February 1947. Two months later the Secretary of AE & CI died and Scorer was given the job. He became naturalised as a South African in 1949.

Apart from such excitement as his career as a company secretary might provide, Derek Scorer may well have considered that his adventurous days were by this time over. In fact they were to begin again, for in 1949 he was offered the job of Managing Director of AE & CI (East Africa), a little company which had just been formed in Kenya to take advantage of the boom in East Africa which followed the start-up of that ill-fated operation known as the Groundnut Scheme. Two years after his arrival in Nairobi the Mau Mau conspiracy began, and Mr. Scorer was to spend three highly-adventurous years fighting it as an officer in the Kenya Police Reserve. Of these experiences he is not keen to speak. They came to an end when the Mau Mau movement was broken at the end of 1954. He then returned to South Africa, where he was appointed deputy manager of Kynoch Ltd., which handled AE & CI's agricultural interests there. In 1956 he was made commercial director of AE & CI, which post he retained until his appointment as Managing Director and Chief Executive this year.

His present "command" amounts to some 16,000 all told, of mixed race and colour, and he is happy to feel that the old divisions between Afrikaans and British and between black and white play no part in the life of the business.

Derek Scorer's manner and way of speech are relaxed, his complexion is appropriately bronzed, and something, somehow, of the city dweller's idea of the wide open spaces seems indefinably to invest his presence. He likes living in South Africa. Apart from its magnificent climate, it is in his view a country of promise and rapid business growth.

Far-flung associates

There is a greater sense these days of being part of the world and not just South Africa, he thinks, and this is nowhere stronger than within AE & CI. They not only employ people of many nationalities of origin, but they have technical and commercial arrangements with Canada, the United States, Germany, Holland, Japan among others—and of course with Great Britain. The mere keeping of contact with such far-flung associates is a big task in itself and one, moreover, which is paralleled in the Company, which is itself spread wide, with branches up and down the immense coast as well as inland. Not infrequently there is 1,000 miles between factories, which often feel themselves remote from the governing body. All of this means a deal of travelling. But here again the notion of "one world" is introducing new patterns of thought, and the "club" idea is gaining ground, by which all those parts of ICI and its associates who have productive interests in a particular subject, whether it be agriculture, paints, research and so on, recognise that they have common interests and meet to discuss them on a global basis—and perhaps to apportion individual research projects among their members. Mr. Scorer is this year host to the "Explosives Club" in this manner. The whole outlook today is cosmopolitan rather than colonial, and the community is cosmopolitan too, which in Mr. Scorer's view makes for tolerance.

He himself has always been drawn towards the Afrikaner way of life. None the less, and by pure chance, he finds himself occupying "a real Anne Hathaway cottage," as he describes it. When he acquired it it possessed a terraced garden with many plants. Feeling that this was going to take too much time to maintain, he sloped it, and has changed flower beds to grass and trees. The kitchen garden has been laid with bricks in the Spanish patio style, "for simplicity of operation." Derek Scorer likes gardening, but even more he likes sailing. Luckily there is a lake only about a dozen miles away where good dinghy sailing is to be had, and his family are as keen as himself. Mr. and Mrs. Scorer have four children, ranging in age from a grown-up son of 24 to a youngster of nine.

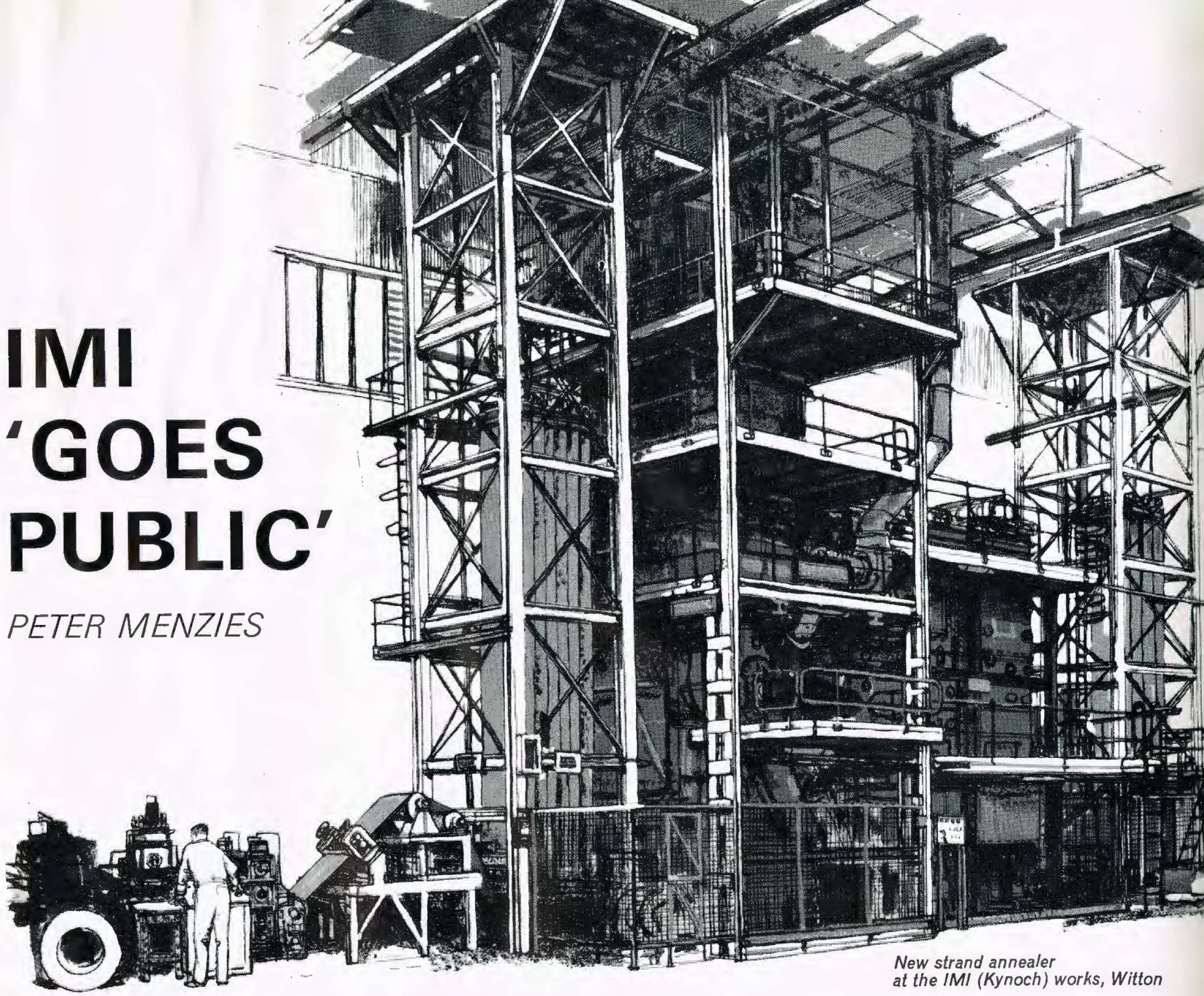
Besides the commitments of his work for AE & CI Mr. Scorer is a member of the Executive Committee of the South African Foundation, a body which exists to help visitors from overseas to see whatever in South Africa they are particularly concerned with or interested in. He helped to form the Fertilizer Society of South Africa (of which he was the founder-chairman) and is active in charitable work.

Normally he visits England about twice a year, and increasingly he expects to become a globe-trotter, representing his company overseas, visiting associates and generally keeping in touch.

In talking with him one feels that he is both proud of and intensely fond of South Africa and its people and glad and proud to be in the modern and cosmopolitan sense a South African. The Briton in him betrays a partisanship only when it comes to discussing Britain's sailing exploits in international competitions, in which she has recently done so well. H.M.

IMI 'GOES PUBLIC'

PETER MENZIES



New strand annealer at the IMI (Kynoch) works, Witton

My My My—IMI is an easy name to remember. This is the caption that launched a series of advertisements which has been appearing in the national press, designed to make the name of IMI better known to a wide public—designed also to build up a separate image for a group of companies which has been steadily learning to stand on its own feet since the beginning of 1962, when IMI was formed as a result of a major reorganisation of ICI's metal interests. The formal announcement at that time said merely: "Responsibility for the present ICI Metals Division and certain subsidiary companies now administered by the Division will be taken over by a new holding company to be known as Imperial Metal Industries Limited. The present Metals Division will become a new operating company, Imperial Metal Industries (Kynoch) Limited."

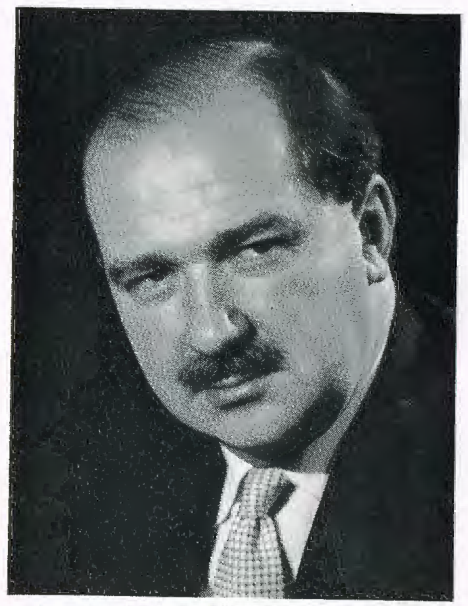
What lay behind this announcement, and why has IMI recently become a public company in its own right? The metal interests came into ICI as part of Nobel Industries Ltd., one of the constituent companies of the 1926 merger. There was little in common, however, between the industrial and commercial traditions and practices of the non-ferrous metals industry and the rest of ICI with its predominantly chemical interests. Over the years it became increasingly apparent that ICI policies, tailored to the needs of the chemical industry, were not always suited to the Metals Division and that the scale and cost of the ICI central services were not required by or appropriate to the Division's operations. This, then, was the principal reason for separating the metal interests from the rest of ICI—the recognition that those interests should be free to develop independent policies suited to their particular needs. The timing of the reorganisation was, however, influenced by a number of factors.

In the 1950s there were a number of changes in the structure of the Metals Division. In 1958 the tube fittings activities, which had been a large and profitable part of the Division, were merged with the corresponding activities of Yorkshire Copper Works Ltd. in a new company, Yorkshire Imperial Metals Ltd. ICI retained a half-interest (since transferred to IMI) in the new company, but this is operated as a separate entity under its own management. Then in 1959 the Division's interests in aluminium were transferred to Imperial Aluminium Co. Ltd. (Impalco), in which the Aluminum Corporation of America (Alcoa) took up a half-interest, the other half being held by ICI. This again is operated as a separate entity under its own management, but here ICI has retained its shareholding, so that IMI has no direct interest in producing wrought aluminium.

The Metals Division which remained after these two operations was much reduced in size and faced considerable problems. Profits declined, partly because overheads previously carried by the tube and aluminium activities had to be spread over a smaller turnover and partly because trade in general was slack. These problems were tackled energetically, and rigorous steps were taken to effect economies and to increase operating efficiency. It was fortunate for ICI that these efforts met with success, as by 1960 important changes

were taking place in the structure of the non-ferrous metals industry which could not fail to increase competitive pressures.

This industry had previously consisted of a number of comparatively small concerns, each tending to specialise in a particular product, e.g. rod or tube. Metals Division was at one time the largest manufacturer in the industry, and also the only one to cover virtually the whole range of wrought products. It was, moreover, the first to acquire a stake in the aluminium industry. In the 1950s, however, amalgamation and rationalisation of a number of smaller units previously operated under separate ownership resulted in the emergence of a few powerful groups. Delta Metal Co. and Enfield Rolling Mills each pursued an expansionist policy and attracted to themselves a number of other companies, a process of amalgamation



St. John Elstub, Managing Director, IMI, and Chairman, IMI (Kynoch)

which finally led to the merger in 1963 of Delta and Enfield to form a single group. In the cable industry BICC and AEI developed and strengthened their businesses in a similar way, and the same process was repeated by YIM in the tube industry.

This concentration into larger units offered obvious advantages, since only firms of substantial size can afford to take the calculated risks associated with progressive policies of commercial and technical development. It was obvious, however, that the Metals Division must also be broadened and strengthened if it was to maintain its competitive position. Prospects for growth in its traditional wrought copper and brass products were very limited, since at the time the UK annual consumption of copper-based products, at 25 lb per head of population, was already the highest in the world. Even in the US consumption per head was only 21 lb and showed little sign of further growth. It was also clear that any business based primarily on copper would be open to the risk of substitution from some of the new plastics which were then developing, as well as from aluminium and other metals.

Fortunately, Metals Division had in the 1950s embarked on the manufacture of "new" metals, principally titanium and zirconium, and had successfully developed this side of its business. The growth potential of the Division as it then existed was however very much less than the potential in other ICI Divisions.

It was against this background that the future of the Division was examined by a committee of ICI directors in 1961, and their recommendations led the ICI Board to take three decisions. In the first place it was recognised that the metals field is one in which the ICI Board, apart from two or three members, have little background knowledge or personal experience, as the work of the Division is outside ICI's customary field of operation. For this reason the Division would benefit by being transferred to a holding company formed for the purpose—Imperial Metal Industries Ltd.—with a Board selected for that company more knowledgeable of its affairs and more responsive to the needs of the metals industry. In the second place it was recognised that the Metals company should be encouraged to grow by suitable mergers with other concerns carrying on related activities. Finally, it was agreed that at the appropriate time steps should be taken to enable the public to have a direct interest in the share capital of IMI Ltd.

These decisions taken in 1961 by the ICI Board were welcomed by the management at Witton. IMI, first under the guidance of Sir James Taylor and latterly with me as its chairman, has implemented the plan not only with enthusiasm but also with a very fair measure of success.

The Group started with four "founder members"—IMI (Kynoch), which manufactures four main groups of products, namely copper and copper alloys in wrought forms (strip, sheet, rod and wire), "new" metals in similar forms, fabricated metal components and ammunition; Marston Excelsior, which is primarily a metal fabricator and manufactures industrial heat exchangers, car radiators and heater blocks, specialised assemblies for chemical engineering and flexible fuel tanks, heat exchangers and other components for aircraft; Lightning Fasteners, which makes metallic and nylon zip fasteners; and Amal, which makes carburettors for small engines and precision engineering products.

On this base of the four "founder members" the Group has in the last four years

Largest in Europe

Second only to the United States in the western world as a consumer of copper, lead and aluminium, the British non-ferrous metals industry is the largest in Europe. It produces wrought products in the form of wire, rods and sections, strip, sheets and tubes, and its 1965 output of copper and copper-alloy wrought products was over 800,000 tons, worth about £375m. Exports of products in wrought form are about 10 per cent of total production, in addition to which a very large tonnage is exported after incorporation in manufactured goods made by the industry's customers.

These figures underline the world and European importance of the industry.

One of the largest producers in Europe of wrought non-ferrous metals other than aluminium is Imperial Metal Industries Ltd., the subsidiary holding company for ICI's interests in the non-ferrous metals (other than aluminium) and allied fields. On 10th March this year ten million 5s. ordinary shares in Imperial Metal Industries Ltd. were offered to IMI employees and to the general public. The offer was oversubscribed seven times: 23,000 applications came in for shares worth almost £28 million, including 2,100 from employees, who applied for almost a million shares.

built up its range of products by the acquisition of a number of companies, the most important of which is Range Boilers. This company, which was acquired in 1965 at a cost of just over £7m., makes copper hot water tanks and cylinders and is IMI (Kynoch)'s largest customer. IMI now has more than 30 subsidiary companies and also holds investments in a number of associated companies. These investments include a 29% holding in Wolverhampton Metal, a company which refines secondary copper and copper alloys and is both a customer of IMI (Kynoch) for copper scrap and a supplier of refined copper.

One such development has already taken place since IMI became a public company —the acquisition of John Wilkinson & Sons (Saltley) Ltd. of Saltley, Birmingham. With their wholly owned subsidiary, Headley, Birch & Co. Ltd., Wilkinson specialise in manufacturing nickel silver and phosphor bronze. They are the second biggest nickel silver producers in Britain and they also manufacture brass and copper in strip and in wire form.

The three main uses of nickel silver are in the telephone industry, in cutlery and in

Copper cylinders made from IMI copper ready for despatch at Range Boilers Ltd.

tableware. Phosphor bronze is used for springs, electrical contacts, and as woven wire in a very wide range of industrial applications.

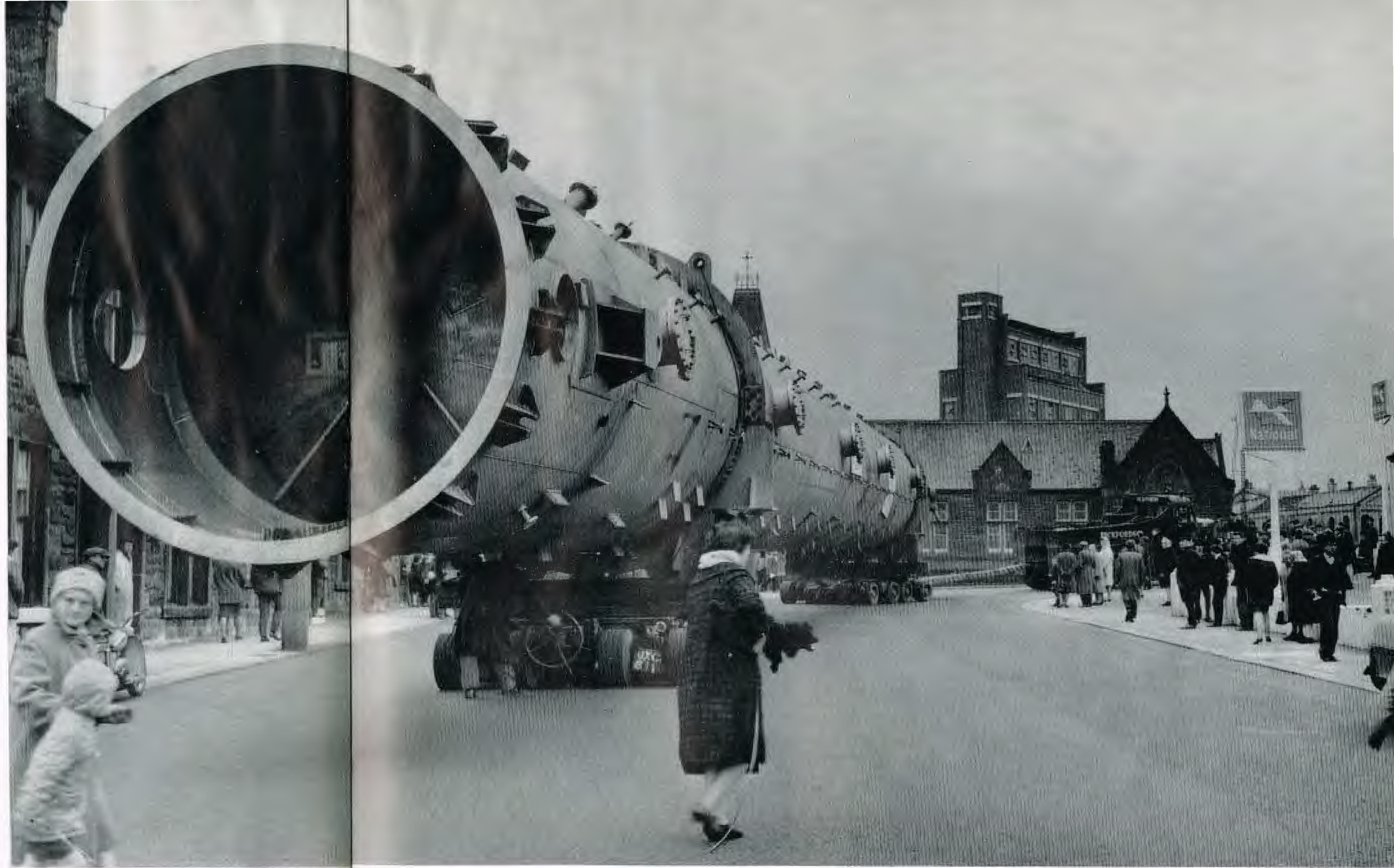
IMI's interests have therefore been extended both forwards, into further fabrication of its traditional products, and backwards, into a source of supply of raw material. The increase in profitability from £1·7m. in 1961 to £4·4m. in 1965 reflects the success achieved in establishing the Group on a sounder basis. By the end of 1965 the ICI Board felt confident that IMI was ready to invite the public to participate directly in financing the Group, and the decision was taken to make a public offer for sale of IMI shares. Such an operation required the publication of a prospectus, and although the Company's financial year did not end until 31st December 1965, the work of preparing the prospectus (including a full statement of the financial position at the year end) was completed in time for its publication on 3rd March 1966. I cannot recall a similar operation being carried through by a company of comparable size in such a short period.

A number of ICI employees and shareholders have asked why the IMI shares were not reserved for issue to them. There is, in fact, a very simple explanation. There are now more than half a million holders of ICI Ordinary Stock, so it would have been very costly to send application forms by post to ICI stockholders. Moreover, the result would have been unsatisfactory; only 10m. IMI shares were offered for sale and allotments would have been very small indeed, so that IMI would have ended up with an unduly large number of shareholders in relation to the number of shares held by the public.

I have also been asked whether the offer of IMI shares to the public is a forerunner of similar action for some other ICI Division. It will now be appreciated, however, that the former Metals Division presented the ICI Board with problems different from those arising from the chemical Divisions, and there is therefore less need to carry through a similar operation for another major part of the business. There is no plan in existence today to carry through a similar operation for another ICI Division.

In addition to issuing new shares to the public, IMI raised £10m. through the issue of a loan stock. About £7m. of the money so raised was required to repay money borrowed for the acquisition of Range Boilers, but the balance remains available for the further expansion of the Group. ICI has many calls from Divisions and subsidiaries on its cash resources, but IMI, by inviting the public to participate directly in its capital, has made itself independent of ICI for the cash required for further development.

PEOPLE PROJECTS PRODUCTS



The 1966 Honor Award of the Commercial Chemical Development Association of America goes to Dr. Alfred Caress (left), ICI Research and Development Director until his retirement in March, for his work in the commercial development of plastics and 'Terylene.' Dr. Caress, first recipient of this honour outside the United States, was given his award by Mr. W. G. Kinsinger, president of CCDA, at a banquet at the Hotel Plaza, New York, on 15th March

Central Distribution Department recently chartered one of the smallest specially-equipped heavy lifting ships in the world – m.v. *Maryke Irene* – to bring in an 80-ton absorption tower (above) from Dunkirk to Ardrossan, Ayrshire, for Dyestuffs Division's new nylon plant at Ardeer. It took 2½ hours for the 136 ft. long tower to complete the five-mile journey from Ardrossan harbour to the Ardeer site

Traquair, an ethylene carrier built to Heavy Organic Chemicals Division's special requirements by the Burntisland Shipbuilding Co. Ltd., was launched on 5th May. The *Traquair,* and its sister ship *Teviot,* will be used mainly to carry liquefied ethylene from the Wilton Works to Rozenburg in Holland, where it will be used in the manufacture of polythene

Teams from five ICI Divisions and ICI Fibres, comprising both management and payroll representatives, visited factories in Canada and the USA to study productivity methods. Four of the teams–from Agricultural, Heavy Organic Chemicals and Mond Divisions and ICI Fibres–flew from London Airport on 7th May and are seen above boarding their VC10 aircraft

A series of three-day courses on the use of computers is being run by the ICI Mathematics and Computer Department for Divisional directors and senior management at Head Office. Those attending a recent course at Brunner House, Winnington, included Lord Beeching (left), one of ICI's Deputy Chairmen, and Mr. Derrick Carter (right), Chairman of Mond Division. With them is Mr. John Steward, Head of Mathematics and Computer Department of Management Services

Marking lanes and edges on the M1 with paint based on 'Alloprene.' ICI recently announced plans to double capacity for 'Alloprene' chlorinated rubber, of which it is already the world's largest producer. Total expenditure on extensions to existing UK plants and new plants in the USA and at Rozenburg in Holland will be between £3 million and £4 million. Other uses for 'Alloprene' include marine paints, concrete and masonry protective finishes, printing inks and industrial and domestic adhesives

ICI is to build a £30 million fertilizer complex at Kanpur in India which when completed in 1969 will be the largest single fertilizer plant in Asia. The project is to be integrated into the activities of ICI's subsidiary, Indian Explosives Ltd. Seen above inspecting the site are (left to right) Mr. John Dick, Technical Director of ICI (India), Mr. Cyril Pitts, Chairman of ICI's Indian subsidiaries, Mr. B. Kumar, Assistant Director of Industries for Uttar Pradesh, and Mr. Malcolm Bowyer, Chief Engineer of ICI (India)

Dr. Adam Lees, at present Deputy Chairman of Nobel Division, will succeed Dr. John Holm as Chairman on the latter's retirement at the end of June. Dr. Henry Samuels, a Commercial Director of Dyestuffs Division, becomes Deputy Chairman. Dr. Lees (left) is seen here with Sir Paul Chambers, ICI Chairman, strolling through the Cliff Gardens at Scarborough on their way to the Central Council meeting on 20th May

RETIREMENT

Field-Marshal Viscount Slim

Lord Slim, a non-executive director of ICI since 1960, retired from the Board on 31st March.

Sir Paul Chambers, ICI Chairman, writes:

Field-Marshal the Rt. Hon. Viscount Slim, KG, GCB, GCMG, GCVO, GBE, DSO, MC, has one of the most honourable and assured places in British military history. Born in August 1891, his military career has been about as varied and exciting as any career could be.

With the Royal Warwickshire Regiment in the First World War, he was wounded at Gallipoli, saw service also in France, was wounded again in Mesopotamia and was awarded the MC. Subsequently he joined the 6th Gurkha Rifles and saw service with the Indian Army.

Back again in Britain, between the wars, he was Instructor at the Staff College at Camberley and at the Imperial Defence College and then returned to India to be the Commandant of the 2nd Battalion 7th Gurkha Rifles and Commandant of the Senior Officers' School in India.

In the Second World War he commanded the 10th Infantry Brigade in the Sudan and was wounded yet again, this time in Eritrea. He saw fresh service with the 10th Indian Division in Syria, Persia and Iraq and was awarded the DSO. He subsequently commanded the 1st Burma Corps in Burma and then commanded the Fourteenth Army. His skill and tenacity in these campaigns, and as Commander-in-Chief Allied Land Forces, SE Asia, gained for him the reputation of being able to turn defeat into victory. He stubbornly refused to accept defeat.

After the Second World War his great skill and experience led to his appointment first as Commandant of the Imperial Defence College and then in 1948 as Chief of Imperial General Staff, the highest military post to which any soldier could be appointed.

Lord Slim's skill, judgment and, above all, his character then became available in the non-military world, and in 1953 he was appointed Governor-General of Australia, which position he held until the expiry of his term of office in March 1960. As Governor-General of Australia he was an outstanding success and gained the respect and admiration of the Australians just as he had of his own troops in India.

Lord Fleck and I both had occasion to visit him in Australia, and we both felt that if he ever became available he would be an excellent choice for a non-executive Director of ICI. By happy timing the first letter I wrote on 1st March 1960 on becoming Chairman of the Company was a letter of invitation to Lord Slim to join our Board.

Those members of our great ICI family who are immersed in the technicalities of production and research may wonder what contribution a great soldier and administrator such as Lord Slim could make to our Board deliberations. In a non-executive Director one does not look for technical knowledge; what one looks for is a capacity to see a Main Board issue from a viewpoint not immediately concerned with the technical or commercial aspects, and to judge whether the Board's decisions as a whole indicate that the Company is moving forward in the right direction. It is easy for technical or financial people occasionally not to see the wood for trees, but this danger does not exist for a non-executive Director who is accustomed to dealing with broad national or international interests and who would not recognise the details of particular trees in the chemical forest.

We have been very fortunate in our non-executive Directors, and their judgment on the broadest issues of policy has been of outstanding importance to the Company. They have helped to keep us along the right path and, above all, prevented us from losing a sense of proportion. In this work Lord Slim's contributions at the Board table have been based upon the wisdom of wide international experience and have been couched in the simple, terse and decisive language one would expect from such a soldier.

Since 1964 Lord Slim has been Constable and Governor of Windsor Castle, an office which he still holds.

Lord Slim retired from the Board on 31st March 1966 and we shall miss him from the Board table, but I am glad to say that he has consented to act as an adviser on certain matters, and we shall therefore be able to consult him with the knowledge that the same wisdom and judgment will be available to us in future on selected Company activities.

OBITUARY

Dr. A. J. Amor, CBE

It is announced with deep regret that Dr. A. J. Amor, who was the Company's principal medical officer from 1946 until his retirement in 1959, died on 8th April at the age of 68.

Dr. A. Lloyd Potter, ICI Principal Medical Officer, writes:

As Principal Medical Officer of the Company Dr. Amor was a well-known figure not only in Head Office but also throughout all the Divisions. He made friends wherever he went, and his personality impressed itself so easily on those who met him that he would never be forgotten. His restlessness, his characteristic poses and habits, his fund of anecdotes, the intense enthusiasms about which he would talk in his quiet but very persuasive voice, and the persistently enquiring mind which made him show such keen interest in everyone's work—all these were qualities which endeared him to his friends and colleagues.

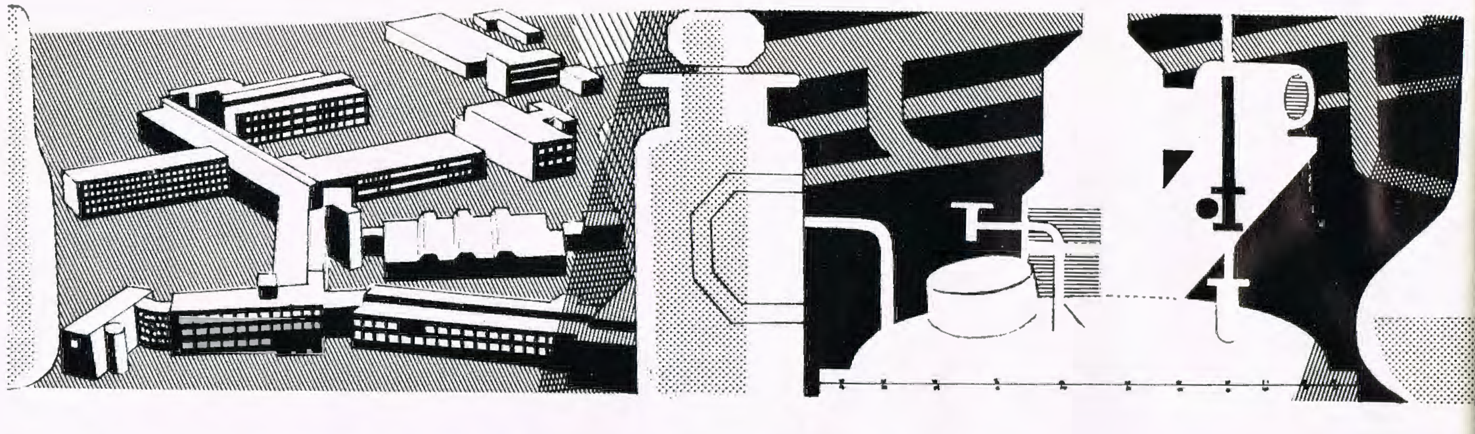
Joe Amor served first as a gunner and later as one of the early pilots in the Royal Flying Corps in the First World War, and after demobilisation in 1919 he took up his medical studies in the Universities of Wales and London. His medical career was devoted almost entirely to the study of occupational medicine, first with the Mond Nickel Company, then as Chief Medical Officer to the Ministry of Supply from 1942 to 1946, and finally as Principal Medical Officer of ICI from 1946 to his retirement in 1959. It was in this latter capacity that we all came to know him and to respect his judgment and his great clinical and administrative ability. He was responsible for setting up the medical service as it is today, and it was his foresight which determined the establishment of the Industrial Hygiene Research Laboratory—the first of its kind in this country.

Even in retirement he continued his interest by becoming medical adviser to the London Electricity Distribution Board.

Dr. Amor loved life and loved people and frequently said he would not want to go on living if he could no longer help his fellow men. To the very end of his wonderfully full life he was able to do just that—to enquire, to learn, and always to help others.

We offer our deepest sympathy to his widow, his daughter and son-in-law and his grandchildren, all of whom meant so much to him.

The grounds of Warren House, the ICI staff training college at Kingston-on-Thames, were open to the public on 1st May under the Gardeners' Sunday Scheme. A total of £124 collected from the 2170 visitors to Warren House, plus proceeds from the sale of 400 booklets, listing gardens open under the scheme, was sent to the Gardeners' Royal Benevolent Society and to the Royal Gardeners' Orphan Fund



UNDER ONE ROOF

A new £7,000,000 factory just opened by Pharmaceuticals Division at Macclesfield completes the logical grouping of all ICI pharmaceutical interests within the Cheshire area. With 1,000 employees and a range of 80 products, the works can produce 1,000,000,000 tablets, 25,000,000 tubes of cream and ointments, and 10,000 bottles of liquids a year. More than half the output is exported. Mr. Sam Howard, Division Chairman, talks to the Editor about this development.

EDITOR: *Why did you choose Macclesfield for this expansion?*

HOWARD: Many people have asked me why we chose the Macclesfield site for our factory. A major factor in the decision was that our demands on the Dyestuffs Division for bulk manufacture were growing at a time (six years ago) when they had a big expansion programme on of their own. The move here has made it possible for us to do more things for ourselves. Some of the other reasons, like transport, access to suppliers and markets, etc., are common to all manufacturing industry, some peculiar to pharmaceuticals. Let us take the special reasons first.

In making a new medicine, several things cannot be forgotten. First, if a chemical is a valuable medicine it is by definition biologically active: acute overdoses and small chronic dosage can be dangerous. Therefore when these new medicines are being made in a factory employees have to be protected from them. Further, the medicine is given to a sick person, sometimes by injection into the bloodstream, so it must be protected from contamination. Finally, it must be produced at the lowest cost.

Now the people who know most about the dangers of a new medicine and about the precautions necessary, who are best able to detect any ill effects of the medicine on workers and suggest how to protect them, who are best able to lay down the precautions against contamination, who can suggest the safest and cheapest processes, are the chemists who invented the new medicine and the doctors who tested it. The factory should be quite near, therefore, to the Research Department and the Medical Services Department. There are some jolly good reasons for having the factory near the Research Department. A research department divorced from a factory can often become a very unreal place, out of touch with real life. It will be a good thing to have the research people well aware that the discovery of drugs has another stage—that they have got to be made in bulk. Our research people at Alderley Park will get a lot out of visiting Macclesfield—and the Macclesfield people will learn a lot from the research side too.

In addition, the normal requirements of a chemical works have to be borne in mind. Large supplies of water, an adequate sewage system, enough people in the district to work the factory and adequate houses for them—all are essential.

This whole mass of both peculiarly pharmaceutical and general logistical requirements was met by the move to Macclesfield. Before, we had to warehouse package components, cardboard for cartons, empty tubes, empty bottles and so on, at Oldham. We had bulk pharmaceuticals being made in the Huddersfield and Blackley factories of the Dyestuffs Division, and then we had to bring these together 250 miles away in Linlithgow, Scotland, and then put the finished material together into storage in Ashton-under-Lyne in a hired warehouse. We were all over the show in those days. Now at last we are mostly under one roof—manufacture, tableting, packing—on one site with plenty of room for expansion.

EDITOR: *What were your main problems—and how did you overcome them?*

HOWARD: The first difficulty was to justify the investment. The plans I displayed to sub-committees of the Main Board must have seemed very dream-like. But at last they decided that I was probably dreaming in a bed of hard fact—as results indeed are proving—and they voted the money.

The second was getting a site. I saw many pieces of land but none was suitable, and then I heard of this industrial estate in Macclesfield. When I first went there the piece of land available was not big enough, being about half the acreage of the present area, but the Town Clerk of Macclesfield, Walter Isaac, put me in touch with one or two firms who had options for sites but did not seem to be keen on developing them. After a talk with these firms we took over their options and built up the site to 81 acres. During this period, Tommy Bland, the Division Secretary, went back over my tracks and did a lot of valuable legal clearing up. Even after many problems had been solved there were important aspects of the size and design of the factory to be settled, and "Tommy" Thompson, our Production Director, Arnold Haigh, Macclesfield Works Manager, and other production people studied the latest ideas from all over the world. All those which we adopted had to be fitted to the sales forecasts. However, the factory grew and is now a going concern.

Before we could get going there was a third problem which started out as two separate ones, but after a time I saw their essential relationship and put them together. The Board of Trade were loath to issue an Industrial Development Certificate because the scheme involved closing down Regent Works in Linlithgow, where employment was scarce, and the building of a new factory in Macclesfield, where it was relatively plentiful. My talk of Macclesfield's intention to take more than 15,000 "overspill" people from Manchester did not impress them.

At the same time the Transport and General Workers' Union (the responsible union at Regent Works) said they did not like our project. John Rhodes of Central Personnel Department arranged a meeting with Jack Williams and Bill Scholes of the TGWU at which I told them the whole plan with all its facets and the reasons for not being able to use Regent Works. After our discussions the union officers told me that while regretting the closure of Regent Works they understood and supported what I was trying to do and the reasons for it. Once I could tell the Board of Trade that the TGWU now understood why the scheme was essential, they let me have the IDC. A long time will pass before I forget the objective way in which Jack Williams and Bill Scholes helped in this matter.

Another difficulty was that we had no engineering director, and while I interviewed several people none seemed to be quite right. Now the trouble with this kind of building is that engineers often dislike it. In the mind of a man who has been making massive plant to turn out thousands of tons of products per annum there is a feeling of demotion—he thinks it just small stuff. But there is in fact just as much scope for cleverness in this sort of thing, and skill, and judgment—it is just that the scale is different. After all, the actual unit of production is in many cases the tablet or the capsule: the technique has been called micro-engineering. A bit different for the man thinking in terms of Billingham, you see! Don't misunderstand me—these people could have built another Wilton or Severnside with skill and despatch, but I wanted a real, honest-to-God pharmaceutical factory. Eventually the late Mr. George Hampshire, who was then an ICI Director, said that Alfred Bennett at Paints Division was probably the man I was looking for, and a talk with him convinced me that this was right. Alfred Bennett had no experience of micro-engineering, but he seemed very keen to learn. He was amazed at the kind of things that had to be done in pharmaceutical factories and eager to have a go. Now this was half the battle.

Soon after the contractors got down to work, the saga of "Cowbelly Clay" began. This sounded like the name of an American Civil War general to me at first, but I soon learned that it was the local name of a clay which had been found on the site and which behaved like a non-drip paint. It was stiff enough to stand on so long as you kept very still but thinned down to gruel consistency if you moved about a bit. This clay was cursed so much that I began to be a little anxious. Never able to resist a telling phrase, I suggested to the people on the site that they should "stop cowbellyaching and dig the stuff out." They had already started this, of course, and it is likely that Derbyshire, which always had Mam Tor, now has *two* quaking mountains, because many loads of the clay disappeared over the border ("South of the Border with Cowbelly Clay").

EDITOR: *What are the unique features of this development?*

HOWARD: There are obviously in the factory many things of which we are very proud. There are, too, some which are not quite so obvious. Many of the machines in the automatic filling and packing lines are unique and are the first models to be supplied to industry. The creams and ointments plant has the largest pans in this business, and they are novel in speed of operation and ease of sterilisation. The sterile processing area is unique in design, and the chemical manufacturing plant has a feature hitherto unknown, in that all the chemical production passes through the final purification area, in which cleanliness disciplines are the same as in the tableting and packing plant. Thus physical safeguards against contamination start at the earliest moment.

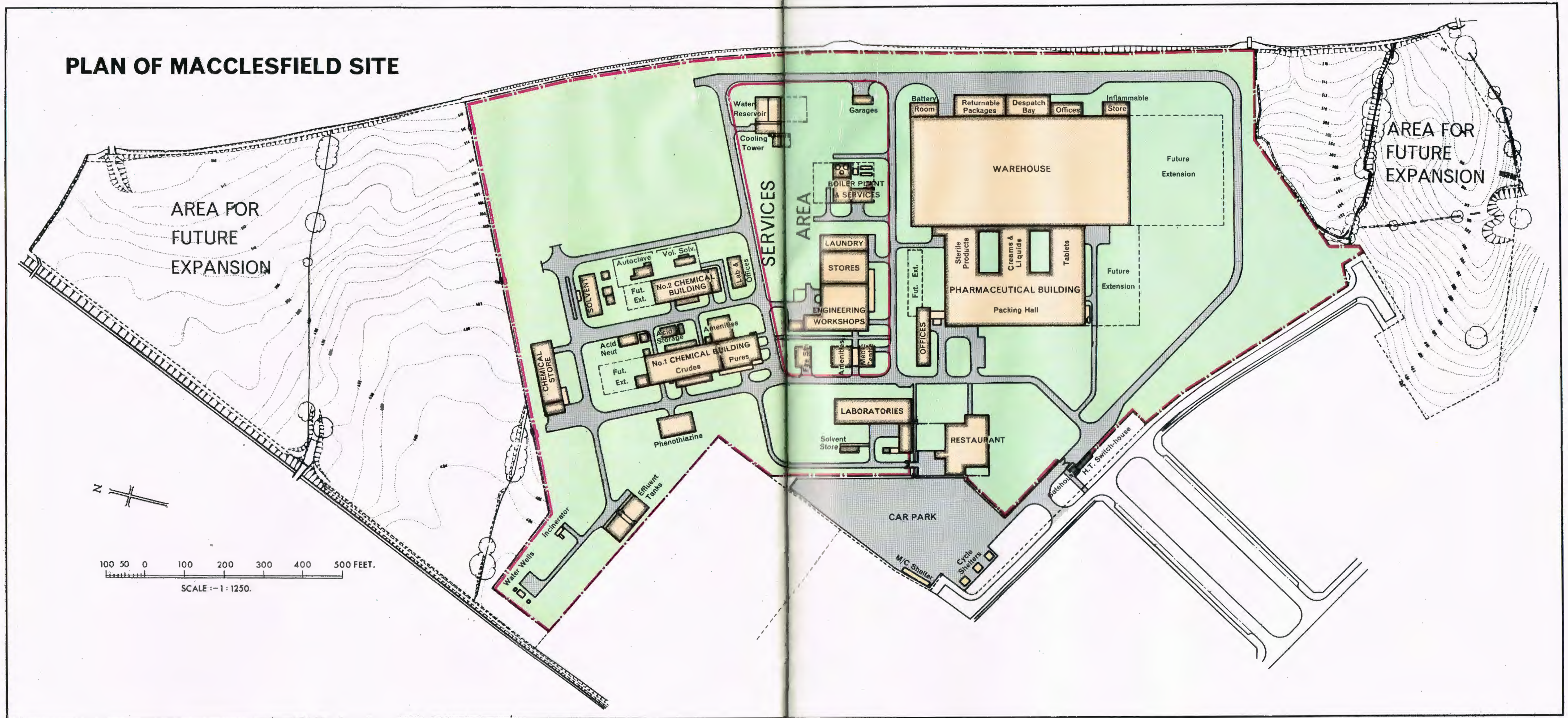
Lord Florey, OM, FRS (left), and Mr. Sam Howard leaving the works entrance after the opening ceremony on 26th April

EDITOR: *Quality standards are described as "very stringent"—please illustrate this.*

HOWARD: The preoccupation with cleanliness and quality control is an attitude of mind essential to all concerned with making medicines. Avoidance of contamination with trace impurities figures quite prominently in the early discussions on the choice of a particular manufacturing process, while processes are sometimes adopted or discarded according to whether the starting materials and reaction conditions are likely to give impurities or not. We pay great attention to dust extraction and we segregate specially toxic materials. We use filtered air, and in short we are always on the look-out for ways of avoiding contamination. After all this we also inspect, test and examine our products at all stages to ensure that our efforts to preserve purity have succeeded. We test the bulk tablets, creams, ointments, injections, bottles, tubes, and other packing materials. When a patient swallows, for example, a tablet of 'Mysoline,' its quality has been ensured by 34 samplings and inspections during its progress, and at least 74 separate analytical operations have been carried out on these samples.

EDITOR: *How much did it all cost?*

HOWARD: The cost of the factory was about £7 million, made up from £2¼ million for pharmaceutical processing (tableting, capsuling, packing, etc.) plant, £2 million chemical manufacturing plant, £1 million warehousing and laboratories, and £1¾ million site development and site services such as offices, workshops, roads, drains, water, electricity and gas mains, canteens, sick bay, etc.



EDITOR: *The cost of the warehouse seems high in proportion. Could you explain why?*

HOWARD: There are two reasons. The warehouse has been built to make it easy to expand: you just push out the walls a bit and don't have to disturb the production at all. And there are ways in which this warehouse, and the processing plant too for that matter, can be made to cope with a much bigger output at a less than *pro rata* cost. We've put a plant on that site about 40 acres in extent, about half the site acreage (see above). Now the remaining 40 acres could increase the earning capacity of that factory not just to twice the present figure at its current size but to three-and-a-half or four times, because all the main services have already been put in. This is just Stage 1 of the whole thing. I can see that in about ten years' time the Division's business will be at least twice what it is now.

EDITOR: *What did you as a Division learn from this project—and how will it help in the future?*

HOWARD: In building the factory we have learned (or re-learned) that design should be as advanced as possible to avoid uncertainties in overall factory planning. We feel sure, too, that prefabricated construction should be used to keep labour off the new site as far as possible, because weather, lack of facilities, necessarily uneven rates of completion of jobs as between various trades—all these make the developing factory site a less than ideal place of work. Anything which can be manufactured away from the site gives a great lift to efficiency.

EDITOR: *How will this plant improve your efficiency?*

HOWARD: Already the new factory, being specially designed for its job, has given a 25% improvement over the improvised arrangements at Regent Works. So far as manpower utilisation is concerned, tableting and packing and the output of creams by ten operatives at Macclesfield using the new machinery is the same as the output from the old machines with twenty-five operatives.

EDITOR: *What are the main staffing and production problems of starting up at Macclesfield while continuing production at Linlithgow? How many staff have transferred?*

HOWARD: To build a new factory and close an old one without disturbing the supplies of our goods seemed a daunting proposition. It meant that stocks had to be accumulated from the old factory well above those needed for current demands, so that the Regent Works employees were working at top pressure although they knew that their factory was going to close. The loyalty of our Regent people was outstanding. Experienced operatives at Regent Works have said that they wanted to stay in Scotland but have come down to Macclesfield for a few months to train local recruits and then gone back again—and all this with good grace, cheerfulness and their usual great skill. There were 400 workers at Regent, and sixty of them have transferred to Macclesfield.

We were concerned about the future of the other 340 people who for understandable domestic or other reasons did not want to leave Scotland. Although we had been very actively trying to find purchasers of the Regent Factory even at a very low price to encourage the setting up of another industry in Linlithgow, years were passing and nothing definite happened. Eventually, however, a Yorkshire clothing manufacturer, R. E. Spence Ltd., bought the factory, and through close co-operation between the new owners and ourselves our employees have been training while with us. They finally ended in our employ when the whistle blew one evening and started next morning with Spence's. Jimmy Gedd, Regent Works Manager and now Deputy Works Manager at Macclesfield, and his people at Regent have done a splendid job of work on this.

You must remember that while this factory was being built the Division was also doing other things—it was earning the money to pay for the factory. Every forecast that I made in 1960 about future profits has been beaten by a magnificent team of people—the Division of 2,500 which exports over £3,000 worth of goods per annum for every man and woman in it. If every firm in this country were as efficient in exporting as the Pharmaceuticals Division employees, the Government would have to apologise to the World Bank for its highly favourable balance of payments!

It has been a fascinating, rewarding time. I sometimes feel that I ought perhaps to retire now while I am winning, but there are two more years to go, and I feel quite sure they will not be dull.

NEFTYANYE KAMNI

– the Russian for "Oil Stones" – is an oil town on stilts 25 miles out in the Caspian. Total work-force is 3500, of whom 1500 at a time live and work on site in 19-day tours of duty

MARTIN WRAY

At the mention of oil, the layman tends to conjure up a picture of burly Texans, "gushers" – and Cadillacs. But the life of an oilman is not always so picturesque. There is discomfort, danger and drudgery too, as recent upsets close to home in the North Sea oil and natural gas ventures have shown. Certainly the members of an ICI mission to the Soviet Union, who had the opportunity of visiting an oil-drilling installation in the Caspian Sea, came away with a feeling of profound respect for the oilmen of Azerbaijan.

Two Main Board Directors, Dr. Alfred Caress and Mr. John Rose, spent a fortnight in February in the USSR at the invitation of the State Committee for Science and Technology, and I was with them. Apart from discussions in Moscow, and visits to research institutes in Moscow, Kalinin and Leningrad, they spent a weekend at Baku on the Caspian. The largest land-locked salt-water lake in the world, the Caspian Sea is 800 miles long, up to 300 miles wide, and up to 3000 feet deep. Baku is some 1300 miles by air from Moscow, and only about 200 miles from the Soviet border with Iran. It is the capital of the Azerbaijan Republic and the centre of one of the largest oilfields in Russia. Everywhere on the outskirts of the city there are forests of conventional oil rigs; oil is so much a part of Baku that it was no surprise to learn that the Mayor – whose overwhelming hospitality the ICI party survived only by virtue of their resilient digestive systems – is by training an oil engineer.

In 1949 the Soviet authorities decided to move offshore and undertake drilling operations directly in the seabed. The first installation built, and the one visited by the ICI team, is called "Neftyanye Kamni" ("Oil Stones"). It is some 60 miles from Baku and 25 miles from the nearest land.

The "Oil Stones" installation stands in a shallow part of the Caspian, and derives its name from a number of rather evil-looking black rocks which protrude above the water level nearby. The installation consists of a complicated network of interconnected piers resting on steel piles driven into the sea bed. The total length of these pier structures is at present over 100 miles, and extensions are being built. Each pier carries a "road" of wooden sleepers, along which the small works bus bearing the ICI visitors was driven at unnerving speed. At intervals along each pier the drill pipes are sunk directly into the sea bed, and the extracted crude oil/water mixture is carried under natural pressure to central storage tanks for transfer by oil tanker to tank farms on shore. To obviate the need for tanker transport, plans are under way for a pipeline along the sea bed to the shore. "Oil Stones" yields about 15 million tons of high quality crude oil a year, most of which is used for such applications as transformer oils.

The focal point of the network of piers is a large platform, also resting on steel piles, and carrying accommodation, a cinema, shop and canteen. There is a helicopter landing platform and a jetty for the daily ferry service from Baku.

We travelled by boat and were given magnificent hospitality by the captain, who put his cabin at our disposal for the entire

Neftyanye Kamni

journey. The boat and the installation itself are both strictly "dry," though fortunately a temporary relaxation was arranged in our honour. The ferry-boat is a modern, diesel-powered vessel equipped with cinema-seating below deck, and a film show is given on each sailing. The normal turnround time at "Oil Stones" is thirty minutes, but in order for us to inspect the installation, and to enjoy an excellent lunch in the restaurant building, the return journey was delayed by three hours, doubtless to the annoyance of the retiring shift.

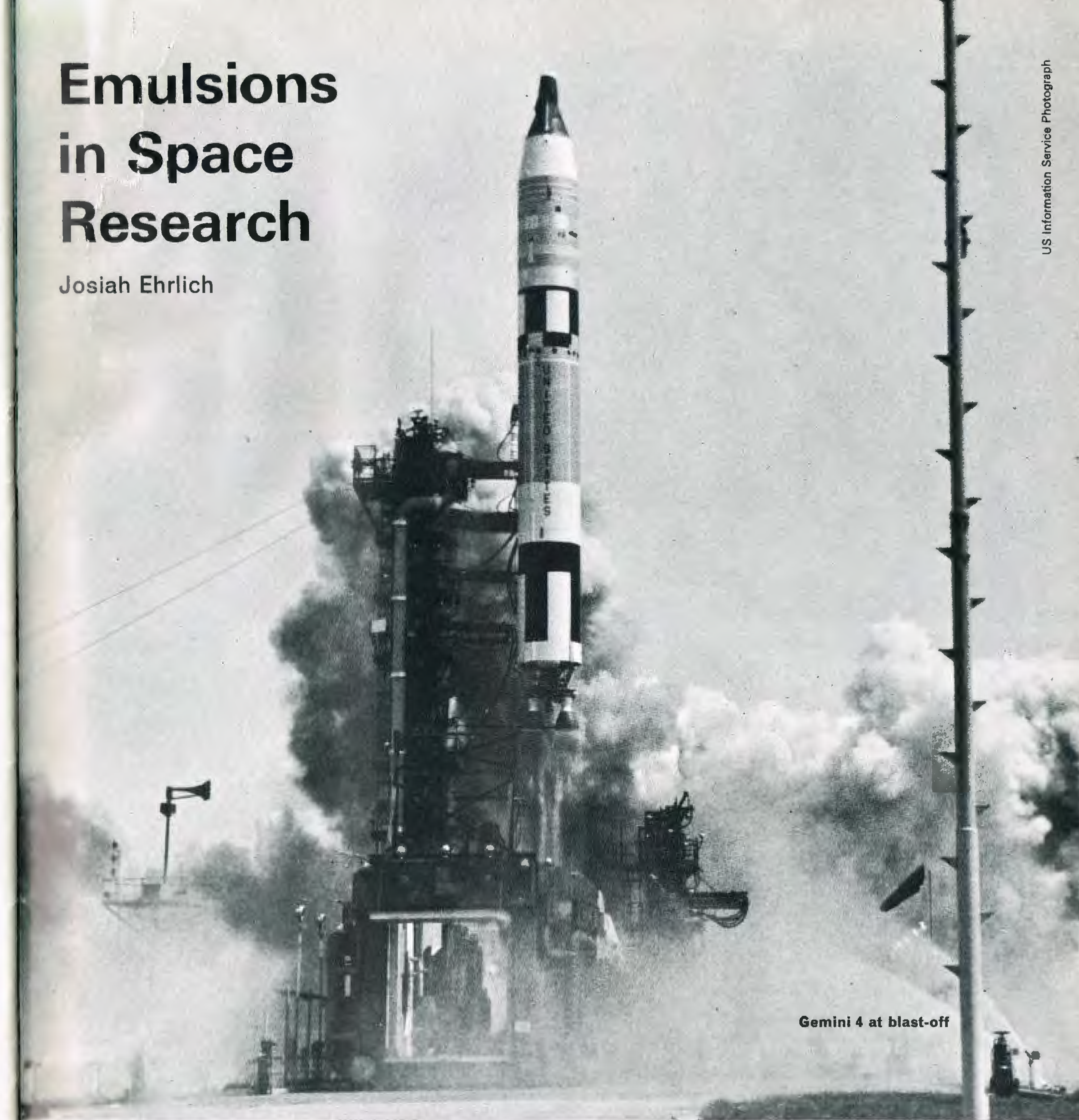
Some 3500 workers are employed, with about 1500 on the installation at any one time. The shift system is complicated, a certain changeover taking place with each daily sailing. In effect, however, each man does a 19-day stint on site, followed by an 11-day break on the mainland. As the unwitting cause of a three-hour delay, we felt a little uneasy on the return journey in the knowledge that our fellow passengers were several hundred swarthy Azerbaijan oilmen who had seen neither their wives (or girl-friends) nor a real drink for nineteen days!

Clearly there are great differences in the sort of problems facing the North Sea prospectors and those in the Caspian. In the relatively shallow water one had the feeling of at least something approaching *terra firma* underfoot, and for a Channel swimmer dry land was almost within striking distance. Nevertheless, the sense of isolation is probably not so very different, and the Caspian, like the North Sea, has its storms. Baku is nicknamed "the town of winds," and there are frequently occasions when both the ferry and helicopter service have to be suspended. At any rate, when we next read in the press of the North Sea operations we shall be able to appreciate more readily the resilience and determination of the sort of men who choose such an uncomfortable way to earn their living.

 The ferry captain, interpreter Mrs. Santalova and Professor Nametkin, head of the Moscow Institute for Petrochemical Synthesis

Emulsions in Space Research

Josiah Ehrlich



US Information Service Photograph

Gemini 4 at blast-off

One of the hazards facing astronauts in projects such as this year's "Gemini" space flights is the presence in space of harmful radiations from which we on earth are protected by the atmosphere. The whole subject of these radiations in space is being investigated by means of special nuclear research emulsions supplied by Ilford Ltd., an associate company of ICI.

Ilford have for many years been known as manufacturers of commercial films and photographic equipment, but it is perhaps less well known that they pioneered the production of materials for recording nuclear events and are acknowledged as world leaders in the preparation of special emulsions for use in radiation research.

They have supplied all the nuclear emulsions used by the US National Aeronautics and Space Administration in the tracking of cosmic and other radiation, and small packs of their emulsions have been carried as personal "dosimeters" by all the astronauts on "Mercury" and "Gemini" flights. Worn beneath the underwear, these packs measure the extent of the radiation to which the astronauts are subjected as they travel through space.

The story of how Ilford gained such a commanding place in this highly-specialised field goes back as far as 1914, when scientists were investigating the effects of charged atomic particles on photographic materials. Both the particles and the materials were, of course, the only ones available at the time—particles from radio-active substances, and

photographic plates which were primarily intended for quite different purposes. Ilford process plates were used.

It was some time before photographic materials were evolved for recording all the known types of particles, but the foundations of the science were laid with work on what are known as the α-particles, which are the most easily detectable.

The scientists concerned with the work were naturally anxious to extend the use of the method, and they suggested the characteristics they would like to see in a material which would best suit their needs. Photographic manufacturers and some non-commercial research workers attempted to produce emulsions which would incorporate these characteristics, and in 1935 Ilford were able to offer two emulsions which were specially intended for this work. Both could be used to detect α-particles, but in addition one of them was also sensitive to protons, the existence of which was by then established.

In 1945 Ilford introduced the first in a new series of emulsions, and these gave such improved results that they were soon given world-wide recognition. To understand why they became so popular we must examine the special requirements of an emulsion intended for this area of research.

All photographic materials consist of an active layer—the emulsion—which is usually carried on a glass, plastic or paper support. The emulsion is a mass of grains or tiny crystals embedded in gelatin which serves to keep the whole mass together. Only the grains are sensitive, and in general they act independently of each other. If a grain is reached by enough light, or some other form of suitable energy, it can later be distinguished from other grains which have not been affected; when the whole sheet is "developed" the affected grains turn black, while the others remain almost white. Further treatment, known as "fixing," makes the image permanent.

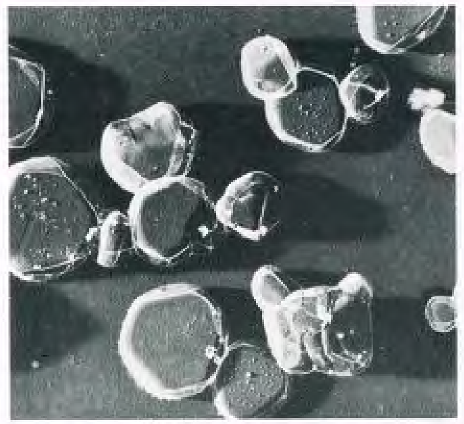
If a particle ejected from a radio-active atom enters a photographic emulsion layer, it will give up a little of its energy to each grain it traverses. This energy, if sufficient, will make the grain developable. Light is not involved in this process.

In all conventional photographic materials, interest lies only in the position *on the sheet* occupied by any part of the image. We do not care, for instance, that the colour-print image of the red pillar-box is slightly nearer the paper base than that of the blue dress of the girl posting the letter. But in nuclear research the scientist is interested in the track formed when a particle, which may be travelling in any direction, goes *through* the emulsion. Here we are not interested in a purely surface effect. In all other applications of photography, attempts are made to reduce the thickness of the active layer to the minimum consistent with other requirements; in nuclear research emulsions, great thickness is desirable in itself. By using a thick layer and, if necessary, building a stack of these layers in which the emulsion is free of any support, the whole of a track may be investigated, whatever the direction of the particles. Key factors are:

1. *Thickness.*
2. *Grain size.* The grains must be small and uniform to permit accurate measurement.
3. *Sensitivity.* The grains must be so sensitive that the passage of a single particle will produce a developable image.
4. *Freedom from background fog.* Since the track will consist of a row of developed grains separated by gaps, a high concentration of grains which develop without having received any intentional exposure would obscure the track itself, so the background must be as free as possible from these grains. It must be remembered that nuclear research emulsions are unique in that the end product is viewed with the highest-powered optical microscopes available. The user is literally searching for faults with a microscope.
5. *Concentration.* To reduce the spacing between developed grains, the sensitive crystals must be highly concentrated.
6. *Uniformity.* Batch to batch uniformity is desirable, so that measurements made in one experiment can be used in a subsequent one.
7. *Ready availability.*

All these properties were considered in preparing the emulsions introduced in 1945. Scientists returning to their peacetime research after the second world war found a ready supply of suitable materials available from Ilford, in whose laboratories a unique method of preparation had been found which gave extremely consistent emulsion of fine grain, yet with very high sensitivity and at a very high concentration.

Moreover, these emulsions were, when fresh, remarkably free from unwanted background. Simultaneously, a method was evolved for producing very thick layers, and 0·6 millimetre has been universally adopted as the most useful thickness. However, layers of more than double this thickness are sometimes demanded and supplied. These thicknesses must be compared with that of the emulsion of conventional materials, which is measured in thousandths of a millimetre.



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PHOTOMICROGRAPHS (×7500) OF SOME EMULSIONS

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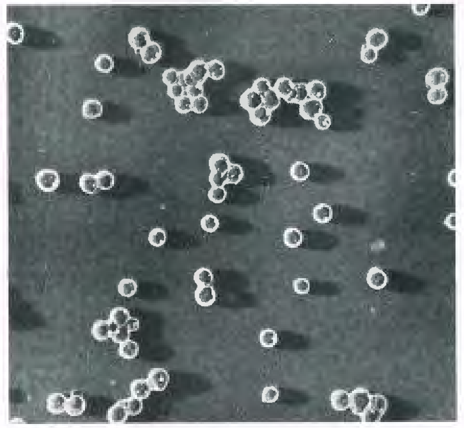

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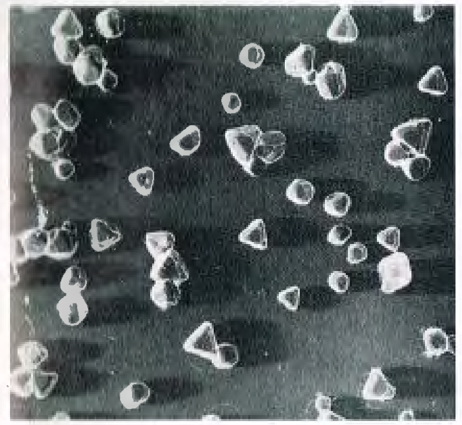

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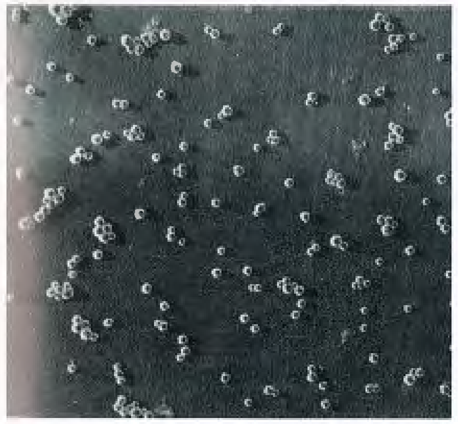

1. Very fast, coarse-grained negative emulsion. 2. Fast medium-grained negative emulsion. 3. Graphic-arts type of emulsion such as is used for blockmaking for illustrations in this magazine. 4. Ilford Nuclear G. 5. Ilford Nuclear K. 6. Ilford Nuclear L

Large "stack" supplied to Chicago University in 1960 being released by balloon from US aircraft carrier "Valley Forge." About half the emulsion output goes to the USA

So far we have considered the first six of the seven requirements, and availability must now be mentioned. From the very moment an emulsion is prepared it is being bombarded by cosmic rays from which there is no practical protection. These rays are of the same nature as those which the material is designed to record. Consequently, if the useful tracks are not to be lost among a welter of others, the emulsion must be fresh. For this reason these materials are not kept in stock or supplied to dealers. The scientist orders his emulsion direct from Ilford and it is made to order.

Demand for these products has been particularly heavy in the USA and at present about half of Ilford's total output goes there. Much original work has been done by the University of Chicago, which in 1960 ordered by far the largest quantity of nuclear research emulsion we have produced for one experiment. We were a little surprised to receive a request for 1000 sheets, each 60 cm × 45 cm and 0·6 mm thick. The total weight of this single order was 1,430 lb, of which almost half was silver, a component common to all photographic emulsions. The emulsion in this one order would have been enough to coat 1,200,000 roll films of 120 size—and it was all to be exposed in one experiment.

Even if we did not have to reckon with the effect of cosmic rays, it would still be impossible to keep nuclear emulsions in stock, because so many different sizes are required. Some machines in which they are used require an almost square format, while others need long, narrow plates. The result is that sizes such as 27 in. × 3 in., 20 in. × 1 in., 6 in. × 6 in. and even 1 in. × 1 in. are all fairly common requirements. In addition to this very large number of sizes, we supply seven standard thicknesses of emulsion, most of them with or without a glass backing, in seven standard emulsion types, so the number of possibilities is almost infinite.

It is not surprising that the range of sizes should be so large. One place in which these emulsions are used, for example, is in the nose cones of rockets, where available space is at a premium. Again, these emulsions are used in the United States' recoverable satellites, and it would be presumptuous of Ilford to dictate to the designers what sizes of emulsions would be acceptable. At the other extreme, large machines such as those at Geneva and at Brookhaven in the USA may be arranged to produce particles which require perhaps a foot-cube of emulsion to record the whole of each interesting track. In other machines the particles are separated according to their energies and fall on different parts of a narrow plate.

Many countries have some machine which requires nuclear research emulsions, and of course work is still being done with cosmic ray research, which requires no machine at all. As a result we export our products to most of the world, and in our last complete trading year 43 per cent went to the USA, 17 per cent to France and 5·7 per cent to Switzerland. India and Denmark took 5·3 per cent and 2·9 per cent respectively. In all we exported to 30 countries, with only 14 per cent going to the home market.

When this work started in 1914 only two types of charged particles were known—electrons and α-particles. Now a far greater number are known, and six of them were discovered in nuclear research emulsions. So far their usefulness has lain in extending knowledge itself, but one can never be sure that more tangible benefit may not accrue, possibly in the field of nuclear power.

Cracker No. 4 starts up. The No. 4 Olefine Plant, operated by the Heavy Organic Chemicals Division at Wilton, shown by day (front cover) and by night (back), is in process of being commissioned. It has a capacity of 200,000 tons of ethylene, which will go into expanding plastics production, notably 'Alkathene,' ICI's brand of polythene, and vinyl acetate. Other products from the cracker include propylene. used in the manufacture of 'Propathene,' the ICI brand of polypropylene, and butadiene, used to make 'Butakon' synthetic rubbers. *Photographs: Michael Taylor*